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EDITORS' OUTLOOK

The outlook for the Spring Meeting at Washington, April 21–26, is most gratifying. In many respects this is the most important meeting in the history of our section. The members will be called upon to decide many fundamental questions.

One far-reaching question is the approval of an outline for High School Chemistry which has been criticized nation-wide since the Milwaukee Meeting and which is now being formulated, in view of these criticisms, by the Committee of Chemical Education to meet the requirements of the various state syllabi and at the same time be suitable for students who are not going to college. It is expected that every state in the union will be represented in making this fundamental contribution to the field of chemistry, and that these representatives will come with a clear understanding of the wishes of their respective states. Only by such representation can it be hoped to make an outline which is to the best interest of American Chemistry. This occasion will furnish an excellent opportunity to meet these representatives and other noted teachers from various parts of the United States.

A second important matter is the business session. There will be an election of officers for the New Division. This is the first opportunity the members have had to elect their own officers as the officers of Sections are appointed by the President of the Society. The new officers will have some additional duties as the writing of the new constitution for the Division, and the shaping of many plans which should spell greater success to our organized chemical education.

The Section has been formally asked by the National Committee on Prize Essay Contest, of which Dr. H. E. Howe is chairman, to take certain responsibilities connected with the prize contest. It is believed that every teacher will be anxious to do his share of work in promoting this project.

The future policies of THIS JOURNAL will be carefully considered. Only the ideas, ideals, and coöperation of the entire section will make the Journal of Chemical Education what it should be. Come and give this publication the benefit of your advice. At the present it is only hoped that THIS JOURNAL is a feeble-initial effort in the right direction.

In addition to the many attractions at the meeting the city has much to offer in the way of technical interest. The chemistry teacher will find great value in visiting the Bureau of Chemistry. These excellently equipped laboratories are busy with all types of chemical problems. The construction of the laboratories, their equipment, and the chemical work in progress, should offer many suggestions. The National Bureau of Standards should be visited. It has no equal in the variety of its standardization work. One finds machines of all degrees of sensitiveness. On the one hand, there is a balance sufficiently sensitive to give a difference in weight of one part in one hundred million. On the other hand, one finds a machine which is capable of exerting a force of five thousand tons. The liquid air machines, which are used in testing materials at low temperatures may be a novelty for some teachers. One will be interested in stepping into the radium testing laboratory.

All are aware of Washington's many attractions of historical interest, such as the Capital, long recognized as a most impressive public building; the White House with all its historical surroundings; the Washington Monument, the greatest piece of masonry in the world; Mt. Vernon, the Nation's Shrine; the Library of Congress, one of the most elaborate library buildings in the World with its nine and a half acres of floor space and one hundred two miles of shelving.

If the chemistry teachers will come to Washington, share the advantages and responsibilities of the Society's meetings, visit the well equipped technical laboratories, and view some of the city's noted historical splendor, they will return to their respective chemistry departments bringing increased inspiration to their students and a feeling to themselves that they are better American Chemists. COME!

N. E. G.

NATIONAL RESEARCH COUNCIL

VERNON KELLOGG, PERMANENT SECRETARY, NATIONAL RESEARCH COUNCIL, WASHINGTON, D. C.

The National Research Council is a coöperative organization of the scientific men of America. Its members include, however, not only scientific and technical men but also business men interested in engineering and industry. It was established in 1916 by the National Academy of Sciences and enjoys the coöperation of the major scientific and technical societies of the country, its membership being largely composed of appointed representatives of over seventy of these societies, representatives of other particular research organizations, representatives of Government scientific bureaus, and a limited number of members at large.

The charter of the National Academy of Sciences, passed by Congress and approved by President Lincoln in 1863, provides that "the Academy shall, whenever called upon by any department of the Government, investigate, examine, experiment, and report upon any subject of science or art." Under this provision the Academy has acted since the time of its establishment as an official adviser of the Government on a wide variety of questions. At the time of its foundation during the Civil War, as the earlier records of the Academy indicate, its committees and its members dealt actively with military and naval problems of precisely the same type as those which insistently pressed for solution during the recent war. It was thus a natural step on the part of the Academy to offer its services to the President at a time, in April 1916, when our relations with Germany were already tense, and for the President to accept the offer and to request the Academy to organize the scientific resources of the country in the broadest and most effective manner to accomplish the objects in view.

The Academy's response to this request was the organization of the National Research Council, which during the war period was partly supported by the Government and served as the Department of Science and Research of the Council of National Defense, and also as the Science and Research Division of the U. S. Signal Corps.

Since the war the National Research Council has been reorganized and adapted to peace conditions to serve as a central agency for stimulating research in the mathematical, physical and biological sciences and in the application of these sciences to engineering and industrial problems, agriculture and medicine. It is now entirely supported from other than governmental sources but maintains close coöperative relations with Government scientific bureaus and their activities.

Under the permanent organization adopted, the Council is composed of thirteen major divisions arranged in two groups. One group comprises seven divisions of science and technology representing, respectively, phys-

ics, mathematics, and astronomy; engineering; chemistry and chemical technology; geology and geography; the medical sciences; biology and agriculture; and anthropology and psychology. The other group comprises six divisions of general relations, representing federal relations, foreign relations, states relations, educational relations, research extension, and research information.

The last named of these divisions, the Research Information Service, is a clearing-house for information about scientific problems, methods, research projects, laboratories and their equipment, instruments and apparatus, bibliography, research funds and fellowships. All of the facilities of this Service are available to science teachers who are endeavoring to carry on research work and need such information as falls within its scope.

Thus, for instance, the Service is developing a comprehensive catalogue of published and unpublished bibliographies on special subjects in science and technology and is able to answer promptly any inquiry for existing bibliographic information bearing on a particular research. Whenever a particular scientific memoir is not accessible to an investigator in the libraries of his locality, he may obtain a photostat copy from the Research Information Service, at small cost, if the publication is available in any collection in Washington.

The Service maintains a file of over 500 catalogues issued by manufacturers and dealers in scientific apparatus and instruments, which has been provided with a detailed subject index on cards so that it is possible to report at once where any instrument or piece of apparatus or laboratory equipment may be procured. Similar information about research chemicals is also available.

Through its contacts with research workers in Government scientific bureaus and in the various universities, colleges and research institutions the Service is in touch with a great deal of research work in progress throughout the country and can frequently assist in establishing communication between investigators in the same special field.

A file of information about funds from which grants in aid of research are made, is also maintained; and a bulletin on fellowships and scholarships offered by American institutions for research and advanced study in science and technology, prepared by the Research Information Service, will be available for distribution early in January, 1924.

ABSTRACTS

Abstracts of all papers to be given before the Section of Chemical Education at the Washington Meeting of the American Chemical Society, April 21–26, should be sent at once, to the Secretary of the Section, Neil E. Gordon, University of Maryland, College Park, Maryland.

A PLEA FOR A PEDAGOGICAL SCRAPHEAP IN CHEMISTRY*

A. P. SY, UNIVERSITY OF BUFFALO, BUFFALO, N. Y.

For many years I have wondered why more high school students do not choose chemistry as one of the required sciences. Surely, those of us who know anything about the subject will agree that it is not only useful, but also attractive. What I am about to say is the result of observations and inquiry, covering several years.

In 1921, the average ratio of students taking chemistry, physics and biology, in high schools in Buffalo, several other large cities, and smaller cities, is shown in the following table:

	Chem.	Phys.	Biol.
Buffalo	1	3.5	5.5
Other large cities	1	1.7	3.7
Small cities	1	2.0	7.0

Undoubtedly there are several reasons for the low ratio of chemistry to the other sciences. In many places the chemical laboratories are poorly equipped, and good chemistry teachers are not always readily available for high schools. But in my opinion, the main reason why chemistry is not more popular, is the fact that we teach a more or less obsolete and unnecessarily difficult content of the subject. High school students generally believe that chemistry is not an "easy" subject.

In the teaching of chemistry, like in all other subjects, there is some unconscious and thoughtless worship of the traditional. Most chemistry teachers probably never question anything they see in text books or laboratory directions. Many still believe that chemistry is an exact science. Many teachers teach what has been taught them, following blindly the text before them, and the method and manner in which they were taught, without ever a change.

Among the chemistry texts of today, we find some that are largely careless compilations, containing ambiguous and misleading statements. Most authors include much that has only a traditional value. Here and there we find an exceptional text, and the majority of chemistry teachers lose no time in adopting it.

Professor Hart, in "Random Recollections of an Old Professor," *Chemical Age*, 1922, p. 404, has this to say: "My experience in teaching chemistry has been an extended one; so long a one that I feel I have a right to an opinion. For most of the text books on the subject that have been written I have nothing but contempt. How intelligent men can put such treatises in the hands of beginners, beginners understand me, is beyond my comprehension. Most of them shoot far over the head of the average student, leaving behind stupefaction and discouragement. Some of the most

* Read at New Haven Meeting of American Chemical Society, April, 1923.

eminent chemists have written the stupidest books for beginners. The worst feature of the whole business is that the authors do not see their blunder when you point it out to them. They persist in thinking that what is clearly perceptible to them after years of intensive training also must be perceptible to men who have had no training; they are quite unable to place themselves in the other fellow's shoes."

I am sure that we as teachers often forget, many of us probably never know, how little a beginner really can learn or comprehend. We would be much better teachers if we could keep this in mind. As teachers in colleges and universities we do not realize that between the spring of the student's high school graduation and the fall of his entrance in college there is a very short summer, barely three months, and no marvelous transformation has taken place. Many of us would be better teachers if we did not know so much.

In my opinion, text books are largely responsible for the methods and content of chemistry courses, although many teachers inject originality and interest into their work.

Many of us can remember when nearly all chemistry texts began with a chapter or two, frequently a synopsis of the whole field of physics. It was thought impossible to understand chemistry without previous training in physics. Happily this practice is seldom found nowadays. Then there are the texts that start with a pretty stiff dose of physical or theoretical chemistry. I have in mind a text, much in use in pharmacy schools, in which the beginner wrestles with the law of multiple proportion, determination of atomic weights, and theories of valence. Another starts with this sentence: "Weight is ponderousness." If nothing else, this should impress the beginner with the fact that he is about to enter upon a weighty subject. Fortunately, the better texts of today no longer follow this custom. They start right off with simple chemistry, which is as it should be. But there are still many poor texts and methods to be found, texts and courses which would have you believe that the chief aim of chemists is to make gases, so that their volumes can be corrected to zero degrees centigrade, and sea level pressure. If it were necessary, I could get data to prove that this volume-temperature-pressure stunt has given many a beginner a most discouraging start, if not a determination to quit altogether. It certainly is one of the things which is stressed too much, makes the subject unattractive, and is really not needed by the beginner.

Some of the other things which have a deadening effect on the beginner are: memorizing atomic weights, boiling points, specific gravities, dates of discovery and name of discoverer. Unless of unusual importance or significance, these data add nothing to the teachability, learnability, or utility of the subject. They belong in advanced courses, dictionaries or encyclopedias.

Years ago I used to spend considerable time and effort to make students understand the law of multiple proportion. I don't have any trouble with it now. I don't try to make them understand it. Why should we waste time on it? All the beginner needs is the law of definite composition, stated somewhat as follows: When two or more elements combine to form a certain compound, that compound always has exactly the same composition. As a matter of fact, there are not enough important examples of the so-called law of multiple proportion to justify the effort usually made trying to teach and learn it. It reminds one of the elaborate and expensive individual fume-carrying devices found in many laboratories; they might be used during two or three experiments during the year,—but they are usually out of commission.

As a student, I had difficulty with the term "anhydride." As a teacher, I find it confusing to students, and it is also superfluous. Why not use "acid oxide" and "basic oxide?" These terms express exactly what we mean. As long as we have the generic term "acid oxides," and the specific name "sulfur trioxide," we certainly don't need the terms "anhydride" and "sulfuric anhydride."

Again, such terms as "dibasic acid" and "diacid base" must tend to confuse the beginner. We don't realize it because we are not beginners. I have no recollection of how and when I finally fixed the meaning of these terms in my mind. Sulfuric acid is a dibasic acid. But why is an acid "basic?" Or twice "basic?" If we wish the student to get the correct idea about this acid, namely, that it contains two replaceable or ionizable hydrogen atoms, why don't we call it a "dihydric acid?" Calcium hydroxide is called a diacid base. But there is nothing "acid" about a base. What we really mean is, that it is a base with two hydroxyl groups, and the logical name for it is "dihydroxy base." There is nothing ambiguous about the terms dihydric acid and dihydroxy base, and the student could understand them instantly, and remember them without difficulty. Later, after ionization has been studied, we might mention such terms as "dihydrionic acid" and "dihydroxionic base," in fact, these terms are already in use in some texts.

One of the best texts in inorganic chemistry I know, calls phosphoric acid "orthophosphoric acid." Goodness only knows why; I don't. Years ago we used to hear about "ortho sulfuric acid." Possibly there were other orthos. Surely, the term is now obsolete.

I have distinct recollections of the difficulties I had as a student to grasp the different oxidations and reductions. We were told that, to add oxygen is an oxidation, and to remove it a reduction. Again, to remove hydrogen from a compound was said to be an oxidation, while adding hydrogen got the name reduction. But that was only part of the mess. To add chlorine to iron chloride (ferrous chloride) was also called an oxidation,

and to remove it a reduction. Nearly all texts and teachers use this confusing nomenclature. What possible objection could there be to the following perfectly logical and simple terms: Oxidation, deoxidation, hydrogenation and dehydrogenation. It wouldn't be necessary to explain their meaning to the student, and it would not be difficult to remember them. As a matter of fact, these terms are already in use in the industries and technical literature. Why not use them in the classroom?

I wish somebody would coin or find two words to express an increase and a decrease in valence. The terms oxidation and reduction were never logical, and now, since we have a new conception of valence they are worse.

Some authors still refer to HCl as hydrogen chloride and also hydrochloric acid. If we define an acid as a substance containing hydrogen, and when dissolved in water forming hydrogen ions, then HCl is hydrochloric acid, and the term hydrogen chloride is unnecessary and confusing to the student. It isn't necessary to have a different name for HCl for the different conditions under which we happen to find it. If we use two names for HCl, then, in order to be consistent, we should also have two names for each for pure H_2SO_4, oxalic acid, tartaric acid, citric acid, oleic acid, and others. And while we are on the subject of acids, I wish somebody would invent a satisfactory name for H_2S. Hydrosulfuric acid does not seem just right; hydrosulfic acid, seems to me, would be preferable.

In teaching ionization I always carefully avoid using the expression "electrolytic dissociation." The term is misleading and certainly confusing to the beginner. The meaning of the word "dissociation" is simple and clear enough, but as soon as we hitch on the adjective "electrolytic," the student passes a current of electricity through the solution. A dissociation in which heat plays a part is called thermal dissociation; when electricity is used it is an electric or electrolytic process, also called electrolysis. Since ionization is an ionic process, and since it usually takes place in solution, why shouldn't it be called ionic dissociation, or solution dissociation, or "solutolysis?"

The terms inflammable and non-inflammable are clumsy and the latter is confusing. Better say flammable and non-flammable.

A beginner should not be confused with equivalent weights. There may be a use for equivalent weights, but I have failed to discover it in over twenty years of teaching. I am very positive that when the beginner learns carefully the meaning of atomic weight, molecular weight, and valence, he has absolutely no use for equivalent weights. Reciprocal proportions was the original expression; then it occurred to somebody that combining weights was less confusing; at present, sentiment, surely not reason, is divided between combining weights and equivalent weights, the latter slightly a favorite. Let us drop them. I am sure the beginner

will get the idea without ever having heard a single one of them, and much confusion will be avoided.

After having told the student that a molecule is a combination of two or more atoms, is it not illogical to speak of monatomic molecules? If metals or anything else exists in the atomic state, why not say so? We do not speak of twins or triplets when only one child is born, nor do we call a man a family. But a "monatomic molecule" is certainly a family consisting of one person, or a team consisting of one horse.

I am never quite sure what to do when directed to collect a gas by upward or downward displacement of air or water. Why not leave just a little to the experimenter to discover for himself? That is the purpose of laboratory work.

Laboratory notes and records, in my opinion, have little value, unless they are made at the time of experiment and not rewritten. There are still teachers who think that the chief value of laboratory notes is neatness. And when laboratory work is properly conducted and recorded, an hour should be called an hour, not half an hour as is almost universally the custom in giving credit.

Organic chemistry (carbon chemistry?) also is partly a puzzle contest for the beginner. One of the first puzzles is monatomic, diatomic, etc., alcohols. Why are alcohols atomic? Oh, that is quite simple, he is told; a diatomic alcohol is one which has two OH groups. But that isn't simple to him. If you are bold enough to ask him to suggest a better term, he might surprise you by suggesting dihydroxy instead of diatomic; and why not dihydroxy? That is exactly what we mean. The terms monacid and diacid alcohol are equally confusing and meaningless with monatomic and diatomic.

Some teachers and texts still refer to oxy acids when hydroxy acids are meant.

Everybody who knows any organic chemistry at all knows the difference between a nitro compound and a nitrate. However, texts and teachers alike seem to make no effort to use the terms correctly. I have in mind especially cellulose nitrate and glyceryl nitrate. The only excuse for calling them nitro cellulose and nitro glycerine is that these are the traditional names for two well known substances; everybody knows they are misnomers. And if the making of a nitrate is called "nitration" in organic chemistry, the making of a nitro compound might be called a "nitrotion." Such a term sounds odd to us who have always heard only the former. But to the student just beginning the study of organic chemistry "nitrotion" would seem perfectly logical and would sound all right. I know, because I have used the term in my classes.

That part of organic chemistry which deals with the saccharides is of unusual importance. But texts and teachers make it unnecessarily diffi-

cult by confusing systems of nomenclature. Some authors call saccharides, carbohydrates, and classify them as monoses, dioses, trioses, etc.; later, monoses are further subclassified, a monose which has three carbon atoms is also called a triose. Then the student also encounters left rotating dextrose, right rotating levulose (spelled *laevulose*), perhaps even inactive "d" and "l" sugars. Then we are still hopelessly mixing dextrose and glucose. I wish we could reserve the latter term for the well known commercial material. Probably it would be best to say "commercial glucose" during the period of weaning from glucose.

If we derive ethyl from ethane and naphthyl from naphthalene, why not benzyl from benzene?

I think it is unfortunate that the terms "ortho" and "meta" are used in both inorganic and organic chemistry with entirely different meanings. And because "para" has not found its way into inorganic chemistry, we make up for it by giving it two meanings in organic chemistry: para disubstitution product and paraformaldehyde. Could we say "trialdehyde," "triformaldehyde?"

I would not quarrel with any one over the use of the sign of equality (=), and the arrow head (→), in writing equations. My preference is the equality sign. There are important equalities in reactions to which the equation should call attention. In the first place we call them "equations," and correctly so. The number of atoms is the same on both sides of the sign; the total weight of reacting substances is the same on both sides; the energy liberated or required on one side is equal to that which was latent, or which has to be applied on the other side.

I think that teachers who use the English language should say azo, not atso, nitro, not neetro, ortho, not orto; and vitamins are vital, not vitreous substances, and the name should be pronounced vite-amins.

I have an idea that one reason why reforms in chemical teaching and nomenclature are coming so slowly or not at all, is the belief that a graduate in chemistry, especially if he has a Ph.D., has the necessary qualifications to teach. As a young teacher he follows tradition, and later he can't break away; everything has become fixed. Nobody should be allowed to teach unless he has studied some pedagogy.

In conclusion, I do not wish to be understood as asking for a uniformly standardized chemistry curriculum; or that "all the children of all the people" should be taught exactly the same chemistry in the same way. That would be most unfortunate. But I do think we should take inventory and start a scrap pile of the useless, unnecessary, obsolete and misleading things that have made our subject unattractive.

I believe everybody ought to know some chemistry, some ought to know more, and some ought to know as much as they possibly can know. This

will naturally follow when the subject is presented more attractively to the beginner. A genuine interest is necessary. After an elementary course interestingly presented, those who do not continue with advanced chemistry will have gotten much more out of it than is the case today. And they would be much less apt to discourage others or spread the notion that chemistry is a difficult and uninteresting subject.

Those who do continue with advanced chemistry are usually not discouraged by anything that follows. Once they are heated to a kindling temperature nothing can stop them. The reaction is exothermic. But we must give them the proper start.

A LIVE CHEMISTRY CLUB IN HIGH SCHOOL

MARTIN V. MCGILL, LORAIN HIGH SCHOOL, LORAIN, OHIO

Lorain High School has had a Chemistry Club for three years. A definite idea of what it attempts may well be obtained from a few paragraphs of its constitution.

The purpose of this club shall be to study further the principles and processes studied in the chemistry classes.

Any person who has studied chemistry is entitled to membership in this club. He must have completed at least two months of chemistry, and have received an average of B— to be eligible. This average must be maintained throughout the chemistry course in order to retain membership in the club.

No one shall be admitted to the chemistry club during the last semester of his High School course.

One month after admittance to the chemistry club, a member shall submit a topic upon which a suitable thesis shall be written; thesis to be in the hands of the instructor not later than six weeks before graduation of the member.

Wherever possible, chemistry club members shall help in the laboratory for one period each day for one semester.

Any member of the club absent from two consecutive meetings without accepted excuse shall be automatically dropped from membership in the club.

The meetings of the club shall be held on the second and fourth Monday evenings of each school month.

The above constitution is lived up to pretty carefully. No attempt is made to imitate the college seminar or to make professional chemists of the students. No student is asked to join nor made to feel in any way that he must retain membership in the organization. The withdrawals are very few.

Once each month a trip is taken to some industrial plant. Among those visited have been the Lorain Water Works, Lorain Ice Plant, Castalia Cement Plant, Grasselli Chemical Company, Nela Lamp Works, Ice Cream Plant and separate trips have been made through the Blast Furnace,

Coke Plant, Bessemer and Open Hearth Departments of the National Tube Company. In addition, the club has visited Oberlin College, Case School of Applied Science and Western Reserve University and the X-ray room of the local hospital.

Once each month such outside speakers as the City Chemist, chemists of industrial plants visited, college professors of chemistry, and doctors, give lectures. It is aimed to have the lecture deal with the workings of the plant we have visited that month; this leads to a very interesting discussion. Only two social affairs are held, one an initiation and Christmas party and the other a party at the home of the instructor, and at each of these a definite program is given.

Once each year the Chemistry Club holds an Open Meeting for the members of all the chemistry classes and their parents, at which a specially prepared program is given in the auditorium, followed by demonstration and exhibit work in the laboratory. These have proven very successful.

The thesis work is designed to keep out those whose interest is entirely that of being amused. Some topics selected have been: "The Making of Cement;" "The Lorain Water Works System;" "The Making of Coke;" "Liquid Air;" "The Making of Steel" and "Chemistry of the Body." Where possible, the students get the information directly from the plant by data and observation in addition to books. The thesis is not intended to be so much a scholarly discussion or exhaustive study as it is a means of arousing the student's interest in some definite work. At present, seven students are carrying out thesis work in direct connection with the teaching of chemistry.

It has been necessary to form two chemistry clubs this year. With an annual enrollment of considerably over one hundred students in the course, the chemistry club became too large; and as Chemistry is largely an elective of the eleventh grade, those who have had a year of chemistry find interest in topics too advanced for beginners. Consequently, the senior club holds one meeting alone, and the junior club, composed of those who enter the course during the current year, holds one meeting alone, and on the last meeting night of each month, a joint meeting is held at which there is an outside speaker. All trips, with the exception of the all-day Cleveland trip, are open to members of the Junior Club as well as of the Senior Club. The present enrollment in the combined clubs is forty. Although held in the evening, the average attendance at meetings is about ninety per cent.

The following program is a fair sample of a regular club meeting:

Roll Call
Reading of Minutes
Business
Ammonia, Some of its Products and Uses
A Cold Storage System (personally inspected and studied by student)

Current Events in Chemistry
Experiment on Freezing Mixtures
Resumé by instructor of address on "Liquid Ammonia," given by President E. C. Franklin of the A. C. S., at the Cleveland Section Meeting.
Lorain, Ohio.

PROGRESS OF COMMITTEE ON CHEMICAL EDUCATION

After the National Committee of ten on Chemical Education was made a committee of the American Chemical Society at the Milwaukee Meeting, it seemed advisable to have a number of regional representatives if the work of the committee was to be executed in the most efficient manner. The following men have thus far been called into service:

G. A. Abbott	University of North Dakota	Grand Forks, N. D.
R. A. Baker	Syracuse University	Syracuse, N. Y.
A. P. Black	University of Florida	Gainesville, Fla.
J. M. Breckenridge	Vanderbilt University	Nashville, Tenn.
G. L. Carter	University of Virginia	University, Va.
G. H. Cartledge	Johns Hopkins University	Baltimore, Md.
J. D. Clark	State University of New Mexico	Albuquerque, N. M.
F. E. Clark	West Virginia University	Morgantown, W. Va.
Jacob Cornog	University of Iowa	Iowa City, Ia.
F. B. Dains	University of Kansas	Lawrence, Kans.
B. C. Hendricks	University of Nebr.	Lincoln, Nebr.
H. N. Holmes	Oberlin College	Oberlin, O.
J. W. Howard	University of Montana	Missouli, Mont.
H. R. Kraybill	New Hampshire College of Agr.	Durham, N. H.
R. N. Maxson	University of Kentucky	Lexington, Ky.
R. K. McAlpine	University of Michigan	Ann Arbor, Mich.
H. W. Moseley	Tulane University of Louisiana	New Orleans, La.
S. R. Powers	Teachers College, Columbia Univ.	New York City
E. L. Quinn	University of Utah	Salt Lake City, Utah
J. W. Read	University of Arkansas	Fayetteville, Ark.
B. B. Ross	Alabama Polytechnic Institute	Auburn, Ala.
G. W. Sears	University of Nevada	Reno, Nev.
Alex Silverman	University of Pittsburgh	Pittsburgh, Pa.
J. A. Smith	University High School	Minneapolis, Minn.
H. R. Smith	Lake View High School	Chicago, Ill.
J. N. Swan	University of Mississippi	University, Miss.
A. P. Sy	University of Buffalo	Buffalo, N. Y.
P. T. Walden	Yale University	New Haven, Conn.
Matthew Wadleigh	Riverside High School	Milwaukee, Wis.
G. H. Whiteford	Colorado Agriculture College	Fort Collins, Colo.
J. E. Wildish	Junior College	Kansas City, Mo.
G. Y. Williams	University of Oklahoma	Norman, Okla.
W. A. Withers	North Carolina State College of Agr.	Raleigh, N. C.

These men are to be highly complimented on the progress which they have made and the business-like manner in which they have carried for-

ward the work. Up to the present time they have been laboring largely with the three following projects:

1. Organization of THIS JOURNAL.
2. Organization of Associations of Chemistry Teachers.
3. Collecting criticisms on the Preliminary outline for high school chemistry.

The work on THIS JOURNAL speaks for itself.

A sample of their work in the organization of associations is exemplified in the "Maryland Association of Chemistry Teachers."[1]

The following quotations will make quite clear the general reaction to the preliminary Outline for the High School Chemistry:

"I think the program is too extensive."

"It should be called a maximum rather than a minimum study course."

"I believe the outline is entirely adequate. If the students could be made to even partially master these suggestions we, in college teaching, would certainly be in luck."

"I looked up the plan which you have proposed and find that it is a very fair outline leaving other topics to be treated to the discretion of the teacher. I think it covers the matter very thoroughly for beginners and I heartily indorse it."

"I think recent advancements should be given a greater place."

It has been very encouraging to find that there has been a demand on the part of a few teachers to give recent advancement in chemistry a more prominent part in the high school outline. It would be equally gratifying if there were more suggestions concerning the omission of certain topics. When new material is included in the high school outline it must be at the expense of some old material, for there is a constant cry that the high school courses are too full and that results lack thoroughness. All teachers are encouraged to give this outline their immediate attention for the committee is aiming to cast this preliminary outline into a temporary outline at the Washington Meeting. It is not believed that it should ever become a so-called permanent outline because of the rapid advancements in our science. If we can come to an agreement on a temporary outline any changes can be made quickly through our national organization of chemistry teachers and THIS NATIONAL JOURNAL.

NEIL E. GORDON, *Chairman*, R. E. ROSE
B. S. HOPKINS W. D. RICHARDSON
J. R. KUEBLER WALTER SCHMIDT
L. W. MATTERN R. E. SWAIN
L. C. NEWELL W. SEGERBLOM

[1] JOUR. CHEM. EDUC., **1**, 18 (1924).

THE NEED OF TRAINED TEACHERS OF CHEMISTRY

B. S. HOPKINS, UNIVERSITY OF ILLINOIS, URBANA, ILL.

A good teacher is the most important factor in any chemical course of study. Expensive laboratories, elaborate equipments, costly reference libraries, superior textbooks, and skillfully arranged courses of study are of little value in the teaching of chemistry unless they are presided over and administered by the mind of an individual who knows and loves chemistry, and who has some skill in the science and art of imparting his knowledge to others.

A large proportion of the students of chemistry come from small or moderately sized high schools in which the average term of service for the teachers who do not hold administrative positions is distressingly short. This is especially true among the teachers of science. As soon as a little experience has been gained and the teacher has reached the point which enables him to be of real service to his school, the call of the larger school of industry or of business becomes imperative and a resignation follows.

There are two sources from which new teachers of chemistry may be sought for these schools whose budget is not equal to the task of demanding teachers of experience, namely, the graduates of either colleges and universities or of normal schools. It is to be deeply regretted that neither of these classes of individuals is, as a rule, adequately trained for the teaching of chemistry. The college graduate who aspires to teach chemistry usually knows his subject well but he has had little or no training or experience in teaching. Under such circumstances he attempts to teach in high school as he has been taught in college, thereby failing to reach the life interest of his pupils. On the other hand, the graduate of a normal school is splendidly trained in the methods of teaching but he rarely knows chemistry and can scarcely be expected to teach well a subject he himself does not understand.

As a result of this situation chemistry is one of the most poorly taught subjects in the curriculum. The relative newness of the subject, the expense of the course, the lack of uniformity of purpose and many other factors contribute their influence toward making this statement true, but the greatest handicap of them all is a lack of adequately trained teachers. How often is it true that the School Board employs a teacher of English, a teacher of Mathematics, a teacher of languages, an athletic director and then assigns the chemistry to anyone on the staff who has room on his schedule for another class? How often is chemistry taught by the principal, the mathematics teacher or the football coach, not because he has any interest in the subject but because there seems to be no other way of arranging the schedule?[1] Successful teaching of chemistry is not to be expected under such circumstances.

This condition of affairs is not the fault of the high schools but arises because the institutions of higher education are not supplying adequately trained teachers of chemistry. The American Chemical Society has appointed a committee whose duty it is to do what it can to improve the teaching of chemistry especially in the High Schools.

But even if it were possible for the committee to devise a perfect course of study of elementary chemistry, no noticeable improvement in chemical instruction could be expected until we have such a course administered by persons trained to appreciate what a high school course should be and how it should be presented. It is safe to assume that the great majority of the successful teachers of the country have won success through careful training, diligent effort and ability to profit from experience.

In order to learn just how far short of the ideal the teaching of chemistry actually falls, a study was made of the conditions in the State of Illinois as shown by the records in the office of the State High School Inspector. The results are shown in the tabulation, but since the records are in some cases incomplete, the figures, especially in the last line, must be considered as only approximately correct:

CHEMISTRY IN HIGH SCHOOLS OF ILLINOIS

	North Central Association	Others
Accredited Schools	235	346
Chemistry offered	205	95
Teachers of Chemistry		
4 years college course	170	74
Additional graduate work	50	8
2 years or more of college	3	12
Less than 2 years college	1	3
Normal School graduates	3	0
2 years or more Normal Training	3	3
Chemistry of Secondary interest	21	34

Essentially two-thirds of the high schools which offer chemistry meet the standards of the North Central Association, with teachers as well prepared as can be expected under the present conditions. Even in such schools, however, one teacher in ten is presumably teaching chemistry under protest and hoping soon to be relieved of this unpleasant duty. In schools which are not accredited in the North Central Association the condition is much less favorable. While seventy-seven per cent. of such schools have college graduates in charge of the chemical laboratory, less than one per cent. of these have done more work than is required for the bachelor's degree, while nearly two per cent. have not graduated and more than thirty-five per cent. appear to have had very little preparation for the teaching of this science.

This situation would not be so serious if it were possible to assume that

all the college graduates were prepared to teach chemistry. But an examination of the catalogues of 108 colleges, universities and normal schools of the Middle West shows that only 15 offer a full-fledged teachers' course in chemistry, while 8 other institutions offer a general course in the teaching of science. If we look still farther into the teachers' course that is offered we see that it is frequently inadequate. For example, at the University of Illinois there are offered the following teachers' courses: English, 2 courses, 4 hours; German, 2 hours; History, 2 hours; Home Economics, 2 courses, 6 hours; Mathematics, 2 courses, $4\frac{1}{2}$ hours; Physics, 3 hours; Chemistry, 1 hour.[2]

If the conditions in Illinois are in any way typical of those in other states it is high time that chemists began to demand that the higher institutions of learning pay more attention to the preparation of chemists who are trained in the noble profession of teaching.

Following the reading of this paper at Milwaukee, there was a lively discussion, at the close of which the following resolution was adopted:

WHEREAS the teaching of chemistry is a highly technical profession requiring both a knowledge of the science of chemistry and of the art of teaching; and

WHEREAS the supply of adequately trained teachers is not now equal to the demand, therefore be it

Resolved by the Section of Chemical Education of the American Chemical Society that the colleges and universities of the country be urged to provide better facilities for the training of teachers of chemistry.

Editor's Note: Dr. Hopkins is giving a very successful course in the teaching of chemistry. We suggest that anybody interested write to him for particulars, which he will be very glad to supply.

[1] The author must not be understood as offering complaint against these combinations of the teaching schedule when the teacher's interest and preparation cover such varied fields. But the protest is aimed at cases in which chemistry is inflicted upon some teacher who is not in sympathy with the subject. There is no reason why the football coach should not teach excellent chemistry provided he has the proper training and is not expected to turn his chemistry class loose in the laboratory while he goes out to whip the team into shape for the next game.

[2] Since this paper was written the University of Illinois has authorized the extension of the Teachers' course in Chemistry to three hours. As offered during the second semester of the present year, the course will include a study of the aims, purposes and methods in the teaching of secondary chemistry, together with the problems of laboratory management. Practice teaching under rigid supervision will also be required.

Local Activities and Opportunities

Johns Hopkins University: Dr. H. A. Taylor, of Princeton University, gave a series of three very interesting lectures at Johns Hopkins Graduate School of Chemistry, on the Radiation Hypothesis. The first lecture had to do with the hypothesis itself, the second with the experimental evidences in favor of it while the third took up the experimental evidences against the hypothesis. Many favorable comments were made upon the lectures.

New England Association of Chemistry Teachers: The monthly industrial excursion for the Central Division of the Association took place Feb. 9th, when members under the leadership of Mr. Card, Chairman of the Industrial Trips Committee, visited the sulfuric acid plant of the Merrimac Chemical Co., at Everett, Mass. The party was conducted through the Plant by Works Manager Wilson.

Prize Essay Contest in Massachusetts: A strong committee of 18 members has charge of the American Chemical Society Prize Essay Contest in Massachusetts. This committee is made up of men and women representing the different phases of chemical activity within the state. Numerous meetings have been held and members of the committee have addressed schools and gatherings that were interested in the contest.

Fellowships in Rubber Chemistry: During the Academic year of 1924–1925 the Municipal University of Akron will offer two graduate Fellowships in the study of Rubber Chemistry. Each fellowship pays $500 per year. Applications must be received before April 1, 1924, and addressed to H. E. Simmons, Director of Knights Chemical Laboratory, Municipal University of Akron, Akron, Ohio.

Assistantships and Fellowships: Six or eight Assistantships and Fellowships in Chemistry with salary ranging from $500 to $1000 are offered by the California Institute of Technology. Assistants and Fellows devote not more than 15 hours per week to instruction. This time includes that required in preparation and in marking note books and papers, as well as that spent in class room and laboratory. Of the remaining time at least one-half must be devoted to research. In general only those men will be appointed Fellows who have had experience equivalent to that required for the Master's degree at a college or university of recognized standing, and who intend to carry on work for the Ph.D. degree. The Assistantships are open to students who have completed thorough undergraduate courses in chemistry, physics, and mathematics and who have demonstrated their interest and resourcefulness in scientific work. In cases where the research justifies it, Assistants and Fellows may be relieved from teaching in order to devote all their time to research.

Students interested in the above appointments should communicate with Prof. Richard C. Tolman of the department of Chemistry.

Assistantships: Twenty-five Graduate Assistantships are awarded annually in the Department of Chemistry, at the Ohio State University. These assistantships demand of the student a limited amount of time for laboratory and other similar assistance along the line of his major subject. The remainder of his time is given to graduate work. These assistantships pay $500 for the academic year and in addition all fixed fees are remitted except the matriculation and diploma fees. Students desiring to apply for these positions may obtain application blanks from the Dean of the Graduate School, the Ohio State University.

Teacher of Inorganic Chemistry: The University of Maryland is looking for an instructor who is qualified to teach freshman chemistry. If interested send qualifications to the Chairman of the Chemistry Department, University of Maryland, College Park, Maryland.

Current Motion Picture Films: The splendid educational motion pictures, listed below, have been produced and are distributed under the supervision of the Department of the Interior, Bureau of Mines, in coöperation with the various industries. These are available to schools without rental charge. They show the mining, manufacture and utilization of mineral products. Requests for loans should be addressed to R. A. Wood, Department of the Interior, Bureau of Mines, Pittsburgh, Pennsylvania.

List of Films.

The Story of Coal. 3 reels—Made in coöperation with the National Coal Operators' Association. It shows the mining and blasting of coal, the loading of mine

cars, underground haulage, and the hoisting to the surface; sizing, cleaning, loading at the tipple and shipment by rail.

The Story of Petroleum. 4 reels—Made in coöperation with the Sinclair Consolidated Oil Corporation. It shows prospecting, drilling, the "bringing in," operation of wells, transportation, refining and distribution.

The Story of Sulphur. 2 reels—Produced in coöperation with the Texas Gulf Sulphur Company. The sinking of the wells, the forcing of superheated water down to the sulphur-bearing strata and the liquid sulphur flowing onto the surface, is shown in detail. The 100,000-ton blocks of sulphur are broken up by blasting preparatory to shipping by rail and water. Then follow loading and community scenes.

The Story of Ingot Iron. 3 reels—Made in coöperation with the American Rolling Mill Company. Begins with the taking of pig iron from the storage pile. Includes firnace operation, ingot pouring, the rolling into thin sheets and shipment of them by rail.

Saving Coal at Home. 1 reel—Made in coöperation with the Associated Pipe and Boiler Industries. This picture emphasizes in an interesting and popular way the advantages of covering domestic heating pipes with insulation.

The Story of Asbestos. 4 reels—This film was produced in coöperation with the Johns-Manville Company, Inc. It shows the mining of asbestos-bearing rock in Arizona and Quebec, how the fiber is recovered therefrom and then manufactured into many well-known products.

The Story of Rock Drilling. 3 and 4 reel copies—Made in coöperation with the Sullivan Machinery Company. This picture shows how various types of drills are used in mining operations: Reel No. 1 shows their application in iron mining; reels Nos. 2 and 3 in the granite industry; and No. 4 in the new ten-mile power canal at Niagara Falls.

The Story of Abrasives. 4 reels—Made in coöperation with the Carborundum Company of America. Shows the generation of power at Niagara Falls, its utilization for the production of carborundum (silicide of carbon) and aloxite (aluminum sesquioxide), and finally the numerous interesting and important industrial operations that are performed with the aid of the abrasives thus manufactured.

Mexico and Its Oil. 4 reels—It shows early attempts to produce petroleum, and the present-day operations of the Sinclair Consolidated Oil Corporation in Mexico, including drilling, storage and transportation by pipe-line and tank boat, along with touches of Mexican life, including the catching with hook and line of an 85 pound tarpon. The picture is beautifully tinted and very entertaining.

"The Modern Goliath" or The Story of Heavy Excavating Machinery. 4 reels—Shows steam and gasoline operated shovels made by the Bycyrus Company with buckets varying in size from 1½ to 8 cubic yards and includes rail track, caterpillar, tower and drag-line equipment. Many of the scenes include operations at large mines, also at railroad and highway construction.

The Story of Natural Gas. 4 reels—Made in coöperation with the Natural Gas Association of America. Shows in interesting detail the locating, assembly of equipment, drilling and casing of a natural gas well, the complicated process of bringing the gas to our homes through gathering lines, field measuring stations, gas compressing stations, gasoline plants and transmission lines to the border of the town or city, city gate measuring stations, medium pressure lines, low pressure regulators, low pressure town and city mains, service cocks, service lines, gas meters, house piping for stoves and other gas using appliances and efficient ways of using them.

Oxygen, the Wonder Worker. 4 reels—Made in coöperation with the Air Reduction Sales Co. Shows the methods of preparing oxygen and acetylene, and the remarkable work done by the oxyacetylene torch in cutting and welding metals.

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NEW FIELDS OF MAGNETIC IRON

(Science Service)

The largest deposits of magnetic iron ore known to man have been discovered in Russia, it became known here to-day through the visit of Prof. Dr. P. Lasareff, director of the magnetic division of the Physical Institute of Moscow, who is in this country as the guest of the American Society of Zoölogists.

Lying near Kursk in European Russia about midway between Moscow and Crimea, they extend for 150 miles, and at one point are 10 to 20 miles wide. The deposits take the form of a great subterranean mountain with its peak 450 feet under ground.

Magnetic observations made primarily for the advancement of science are responsible for the discovery, Prof. Lasareff explained.

For fifty years the compass needle has been known to act strangely in the vicinity of Kursk. The vertical dip at one point was over three times as great as that at the magnetic North pole where the earth's magnetism is felt most strongly.

In 1919 while civil war was still in progress in that region, Prof. Lasareff, using only instruments constructed in the laboratory at Moscow, began a magnetic survey of the area for the Russian Academy of Sciences, of which he is a member. Investigations continued during the summers following, and gravitational measurements were added to the magnetic.

To measure the force of gravity, Prof. Lasareff used the Eotvos balance, a very sensitive instrument invented in Germany, that will detect very small changes in gravity caused by masses in the earth's crust. It is said that this new device is so sensitive that it will detect a man thirty feet away.

Combining the gravitational and magnetic observations, Prof. Lasareff was able to map the deposits of magnetic iron ore before they were discovered.

Diamond and churn drills were set at work at points designated by Prof. Lasareff and the huge ore body of magnetite was actually found. It lies about 450 feet under the surface and already the drills have penetrated over 500 feet without any sign of its exhaustion. The top portion of the deposit analyzes 40 to 45 per cent. iron, but deeper portions run over 50 per cent. So colossal is the deposit that Prof. Lasareff would not attempt to estimate the quantity in tons. The next largest deposit known is in Norway and has a length of only about six miles.

After the steel churn drilling tool had penetrated the deposit of ore for about 100 feet it became so highly magnetized that it would attract and hold ten to twenty pounds of iron.

This summer Prof. Lasareff will make an exploratory trip into Siberia and the same methods of investigation will be used.

Prof. Lasareff believes that with the possible exception of the United States and Canada, Russia is the land of greatest promise for future natural resources.